

**Section II. (REMARKS)**

The pending claims in the application are 1, 3-14, 18-29, 31-40, 42-48 and 97.

**Request for Rejoinder Reminder**

Applicants acknowledge the Examiner's indication that pending method claims 49, 51-62 and 66-96 will be rejoined upon allowance of the composition claims 1, 3-14, 18-29, 31-40, 42-48 and 97. Towards that end, withdrawn method claims 49, 51-56, 66-70, 74-76, 78, 79, 85, 86 and 92 have been amended in a manner consistent with the pending composition claims.

**Allowable Subject Matter**

In the April 4, 2005 Office Action, claim 17 was objected to as being dependent upon a rejected base claim, but was indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, applicants have amended claim 1 to include the limitations of claim 17 and intervening claim 15, thereby obviating the Examiner's objection. Thus, pending claims 3-14, 18-27, and 45-48, which directly or indirectly depend from claim 1, are in condition for allowance.

**Amendment to the Claims**

Claim 1 has been amended herein to recite:

**"A composition for cleaning semiconductor wafers, wherein the composition includes supercritical fluid, at least one fluoro species, and an inhibitor that is effective to inhibit attack of the cleaning composition on low dielectric constant layer material, wherein said inhibitor comprises boric acid."**  
(emphasis showing claim amendment)

Claim 1, as amended, includes the limitations of claim 17 and any intervening claims. Claim 49

has been correspondingly amended.

Claim 28 has been amended herein to recite:

**"A composition for cleaning semiconductor wafers, wherein the composition includes supercritical fluid, at least one primary and/or secondary amine(s), and at least one surfactant, wherein the primary and/or secondary amine(s) include at least one amine species selected from the group consisting of hydroxylamine (NH<sub>2</sub>OH), ammonia (NH<sub>3</sub>), alkylamines (R-NH<sub>2</sub>) and dialkylamines (R<sub>1</sub>R<sub>2</sub>NH), wherein R, R<sub>1</sub> and R<sub>2</sub> are each independently selected from C<sub>1</sub>-C<sub>6</sub> alkyl and C<sub>6</sub> aryl."** (emphasis showing added limitations)

Claim 28 includes the limitations of claims 30 and 41. Claim 76 has been correspondingly amended.

Claims 3-8, 18-22, 26, 27, 37, 38, 44, 51-56, 66-70, 74, 75, 85, 86 and 92 have been amended herein to alter the claim dependencies and/or make the claims consistent with the amendments made herein.

Claims 31 and 79 have been amended to recite that the composition further comprises an inhibitor. Support for such amendment can be found in the instant application at paragraph [0041]. New claim 97 and withdrawn claim 78 depend from claims 31 and 79, respectively, and further define that the inhibitor comprises boric acid.

No new matter has been added herein.

#### **Rejection of Claims on Reference Grounds, and Traversal Thereof**

In the April 4, 2005 Office Action:

claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by Mullee (U.S. Patent No. 6,306,564);

claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b)<sup>1</sup> as being anticipated by Castrucci (U.S. Patent No. 6,521,466);

claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b)<sup>2</sup> as being anticipated by Mullee (U.S. Patent No. 6,871,656);

claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by DeSimone et al. (U.S. Patent No. 5,944,996); and

claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b)<sup>3</sup> as being anticipated by McClain et al. (U.S. Patent No. 6,743,078).

These rejections are traversed in application to the claims as amended herein. The patentable distinction of the claims over the cited references is set out below.

#### **Rejections under 35 U.S.C. §102**

1. In the April 4, 2005 Office Action, claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by Mullee (U.S. Patent No. 6,306,564) (hereinafter Mullee '564). Applicants traverse such rejection.

As discussed hereinabove, claim 1 has been amended to include the limitations of claim 17 and intervening claim 15. Thus, pending claims 3-14 and 18-27, which directly or indirectly depend from claim 1, are patentably distinct over Mullee '564 and in condition for allowance.

Pending claims 29, 31-40, 42-44 and 97 directly or indirectly depend from claim 28, which recites, *inter alia*:

#### **"A composition for cleaning semiconductor wafers, wherein**

<sup>1</sup> the correct subsection under section 102 is actually §102(a) based on an issue date of February 18, 2003.

<sup>2</sup> the correct subsection under section 102 is actually §102(e) based on an issue date of March 29, 2005 for the reference cited by the Examiner.

<sup>3</sup> the correct subsection under section 102 is actually §102(e) based on an issue date of June 1, 2004 for the reference cited by the Examiner.

**the composition includes supercritical fluid, at least one primary and/or secondary amine(s), and at least one surfactant . . . .” (emphasis added)**

Mullee '564 teaches the inclusion of NMP, diglycol amine, hydroxyl amine, tertiary amines, catechol, ammonium fluoride, ammonium bifluoride, methylacetoacetamide, ozone, propylene glycol monoethyl ether acetate, acetylacetone, dibasic esters, ethyl lactate, CHF<sub>3</sub>, BF<sub>3</sub>, other fluorine containing chemicals, acetone, diacetone alcohol, DMSO, ethylene glycol, methanol, ethanol, propanol, or isopropanol (see Mullee '564, col. 4, lines 12-28) in the CO<sub>2</sub>-containing composition, **none of which qualify as a surfactant**. Accordingly, Mullee '564 is completely devoid of any teaching or suggestion relating to the inclusion of a surfactant in the CO<sub>2</sub>-containing composition.<sup>4</sup>

It is well established, as a matter of law, that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987).

Clearly, Mullee '564 does not satisfy this standard and as such, Mullee '564 does not anticipate applicants' claim 28 or claims 29, 31-40, 42-44 and 97 depending therefrom.

Withdrawal of the rejections under §102 in view of Mullee '564 is respectfully requested.

2. In the April 4, 2005 Office Action, claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by Castrucci (U.S. Patent No. 6,521,466). Applicants traverse such rejection.

As discussed hereinabove, claim 1 has been amended to include the limitations of claim 17 and intervening claim 15. Thus, pending claims 3-14 and 18-27, which directly or indirectly depend from claim 1, are patentably distinct over Castrucci and in condition for allowance.

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<sup>4</sup> It is noted that the Examiner did not point out where in Mullee '564 surfactants were taught or suggested, even though the claims reciting the inclusion of surfactants were rejected in view of Mullee '564.

Regarding pending claims 28, 29, 31-40, 42-44 and 97, Castrucci teaches the inclusion of methanol, isopropyl alcohol and other related alcohols, butylene carbonate, propylene carbonate and related carbonates, ethylene glycol and related glycols, ozone, hydrogen fluoride and related fluorides, ammonium hydroxide and related hydroxides, citric acid and related acids (see Castrucci, col. 8, lines 40-46) in the supercritical fluid composition, **none of which qualify as a surfactant**. In fact, the only reference to surfactants in Castrucci involves the removal of surfactant contaminants from surfaces using  $\text{SCCO}_2$  (see Castrucci, col. 2, lines 47-50), which is contrary to applicants' claimed invention, wherein the surfactant is included in the composition for cleaning purposes. Accordingly, Castrucci is completely devoid of any teaching or suggestion relating to the inclusion of a surfactant in the supercritical fluid composition.<sup>5</sup>

Clearly, Castrucci does teach or suggest each and every element as set forth in applicants' claimed invention and thus, Castrucci does not anticipate applicants' claim 28 or claims 29, 31-40, 42-44 and 97 depending therefrom.

Withdrawal of the rejections under §102 in view of Castrucci is respectfully requested.

3. In the April 4, 2005 Office Action, claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by Mullee (U.S. Patent No. 6,871,656) (hereinafter Mullee '656). Applicants traverse such rejection.

As discussed hereinabove, claim 1 has been amended to include the limitations of claim 17 and intervening claim 15. Thus, pending claims 3-14 and 18-27, which directly or indirectly depend from claim 1, are patentably distinct over Mullee '656 and in condition for allowance.

Regarding pending claims 28, 29, 31-40, 42-44 and 97, Mullee '656 teaches the inclusion of NMP, di-isopropyl amine, tri-isopropyl amine, mono-ethyl amine, diglycol amine, hydroxyl amine, tertiary amines, and other amines, catechol, ammonium fluoride, ammonium bifluoride, methylacetoacetamide, ozone, propylene glycol monoethyl ether acetate, acetylacetone, dibasic

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<sup>5</sup> It is noted that the Examiner did not point out where in Castrucci surfactants were taught or suggested for inclusion in the cleaning composition. The only mention of surfactants in the Examiner's remarks involved the recitation of a surfactant as an organic contaminant that can be removed using  $\text{SCCO}_2$  (see April 4, 2005 Office Action, page 7, lines 1-3).

esters, ethyl lactate,  $\text{CHF}_3$ ,  $\text{BF}_3$ , other fluorinated compounds, methanol, ethanol, propanol, IPA, diethyl ether, acetone, diacetone alcohol, DMSO, ethylene glycol and combinations thereof (see Mullee '656, col. 2, lines 4-21) in the supercritical fluid composition, none of which qualify as a surfactant. Accordingly, Mullee '656 is completely devoid of any teaching or suggestion relating to the inclusion of a surfactant in the supercritical fluid composition.<sup>6</sup>

Clearly, Mullee '656 does teach or suggest each and every element as set forth in applicants' claimed invention and as such, Mullee '656 does not anticipate applicants' claim 28 or claims 29, 31-40, 42-44 and 97 depending therefrom.

Withdrawal of the rejections under §102 in view of Mullee '656 is respectfully requested.

4. In the April 4, 2005 Office Action, claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by DeSimone et al. (U.S. Patent No. 5,944,996) (hereinafter DeSimone). Applicants traverse such rejection.

As discussed hereinabove, claim 1 has been amended to include the limitations of claim 17 and intervening claim 15. Thus, pending claims 3-14 and 18-27, which directly or indirectly depend from claim 1, are patentably distinct over DeSimone and in condition for allowance.

Regarding pending claims 28, 29, 31-40, 42-44 and 97, DeSimone teaches a composition including a carbon dioxide fluid and an amphiphilic species. Regarding the inclusion of amines in the supercritical fluid composition, DeSimone recites:

- “[a]lthough not necessary, the  $\text{CO}_2$  fluid can be employed in a multi-phase system with appropriate and known aqueous and organic liquid co-solvents. Such solvents may be those that are miscible or immiscible in the  $\text{CO}_2$  fluid and include, for example, . . . amines . . . (see DeSimone, col. 2, lines 57-62);
- “[e]xemplary  $\text{CO}_2$ -phobic segments [of the amphiphilic species]<sup>7</sup> [ ] may also

<sup>6</sup> It is again noted that the Examiner did not point out where in Mullee '656 surfactants were taught or suggested, even though the claims reciting the inclusion of surfactants were rejected in view of Mullee '656.

<sup>7</sup> this amine recitation relates to segments on the amphiphilic species, which is not equivalent to applicants' amine compounds.

comprise molecular units containing various functional groups such as . . . amines . . . (see DeSimone, col. 3, lines 50-60); and

- [i]n a number of applications, it may be preferable to use high boiling low vapor pressure cosolvents. [ ] Other co-solvents include . . . amines . . . (see DeSimone, col. 4, lines 38-52).

In other words, DeSimone teaches the optional inclusion of amines in the supercritical fluid composition.

It is well established as a matter of law that a rejection on grounds of anticipation cannot be predicated on an ambiguous reference. *In re Turlay*, 134 U.S.P.Q. 355, 360 (CCPA 1962). A reference is effective only for that which it clearly and definitively discloses. Further, if a reference is ambiguous and can be variously interpreted so that it may, in one interpretation, and may not, in another interpretation, constitute an anticipation of an applicants' claim, an anticipation rejection under 35 U.S.C. §102 based on such ambiguous reference is improper. *In re Hughes*, 145 U.S.P.Q. 467 (CCPA 1965).

Amines are optional components in the DeSimone composition and as such, there are two different interpretations of this specific DeSimone teaching. Thus, DeSimone does not clearly and definitively disclose that amines must be present in the composition, as claimed by applicants in independent claim 28 herein.

Accordingly, DeSimone does not anticipate applicants' claim 28 or claims 29, 31-40, 42-44 and 97 depending therefrom.

Withdrawal of the rejections under §102 in view of DeSimone is respectfully requested.

5. In the April 4, 2005 Office Action, claims 1-16 and 18-48 were rejected under 35 U.S.C. §102(b) as being anticipated by McClain et al. (U.S. Patent No. 6,743,078) (hereinafter McClain). Applicants traverse such rejection.

As discussed hereinabove, claim 1 has been amended to include the limitations of claim 17 and

intervening claim 15. Thus, pending claims 3-14 and 18-27, which directly or indirectly depend from claim 1, are patentably distinct over McClain and in condition for allowance.

Regarding pending claims 28, 29, 31-44 and 97, McClain teaches CMP polishing slurries containing CO<sub>2</sub>. Regarding the inclusion of amines in the McClain supercritical fluid composition, McClain discloses alkanolamines as the hydrophilic group coupled to a CO<sub>2</sub>-philic group in a surfactant molecule<sup>8</sup> (see McClain, col. 10, lines 3-22), and that conventional surfactants, including alkanolamines and amines, may be used (see McClain, col. 10, lines 31-40).

It is well known in the art that the hydrophobic portion of a surfactant compound generally has greater than six carbon atoms (see, e.g., [www.physchem.ox.ac.uk/~rkt/topics/surfactant.html](http://www.physchem.ox.ac.uk/~rkt/topics/surfactant.html)).<sup>9</sup> Compounds having both hydrophilic and hydrophobic portions, wherein the hydrophobic portion includes six (6) or less carbon atoms, typically have a hydrophobic portion that is too small to associate with other hydrophobic compounds and as such, are not usually classified as amphipathic.

Applicants' claim 28 recites:

**"A composition for cleaning semiconductor wafers, wherein the composition includes supercritical fluid, at least one primary and/or secondary amine(s), and at least one surfactant, wherein the primary and/or secondary amine(s) include at least one amine species selected from the group consisting of hydroxylamine (NH<sub>2</sub>OH), ammonia (NH<sub>3</sub>), alkylamines (R-NH<sub>2</sub>) and dialkylamines (R<sub>1</sub>R<sub>2</sub>NH), wherein R, R<sub>1</sub> and R<sub>2</sub> are each independently selected from C<sub>1</sub>-C<sub>6</sub> alkyl and C<sub>6</sub> aryl."** (emphasis added)

Comparing McClain with applicants' claim 28, it can be seen that McClain does not teach or suggest applicants' primary and/or secondary amines having no more than six carbon atoms in the alkyl or aryl portion(s). Instead, McClain discloses amines that have surfactant properties,

<sup>8</sup> this amine recitation relates to segments on the surfactant species, which is not equivalent to applicants' amine compounds.

<sup>9</sup> see also, *Kirk-Othmer Concise Encyclopedia of Chemical Technology*, pg 1143, attached herein in Appendix A.



i.e., must have greater than six carbon atoms in the hydrophobic portion to be characterized as a surfactant.

Accordingly, McClain does not anticipate applicants' claim 28 or claims 29, 31-44 and 97 depending therefrom.

Withdrawal of the rejections under §102 in view of McClain is respectfully requested.

#### **Fees Payable**

Eleven (11) dependent claims have been cancelled, two (2) dependent claims have been converted into independent claims and one (1) dependent claim has been added herein. Accordingly, no fee is due at this time.<sup>10</sup>

Authorization is hereby given to charge any deficiency in applicable fees for this response to Deposit Account No. 08-3284 of Intellectual Property/Technology Law.

#### **Conclusion**

Based on the foregoing, pending claims 1, 3-14, 18-29, 31-48 and 97 are in form and condition for examination. If any additional issues remain, the Examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same.

Respectfully submitted,



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<sup>10</sup>  $(11 \times \$50.00) - [(2 \times \$200.00) + (1 \times \$50.00)] = \text{net credit}$

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